

## **Appendix E**

### **Revisions to April 2005 Nutrient and DO High-Flow TMDL for Christina River Basin**

## Appendix E

### Revisions to April 2005 Nutrient and DO High-Flow TMDL for Christina River Basin

On April 8, 2005, the Region III (Philadelphia, PA) office of the Environmental Protection Agency (EPA) established Total Maximum Daily Loads (TMDLs) for nutrients and dissolved oxygen (DO) under high-flow conditions for the portions of the Christina River Basin listed on the Clean Water Act Section 303(d) lists for the Commonwealth of Pennsylvania and the State of Delaware. Additional information has become available for CSO and NPDES discharges that prompted this revision to the April 2005 TMDLs. The updated information is described in this appendix.

#### E.1 Event Mean Concentrations for Wilmington CSO Discharges

Following the establishment of the Christina River Basin nutrient and DO high-flow TMDLs, the City of Wilmington and Delaware DNREC completed a storm-monitoring program. The goal of the storm-monitoring program was to collect nutrient and bacteria data from four storm events to establish characteristic concentrations for the CSO discharges in the City of Wilmington. Two storm events had been completed prior to the April 2005 TMDL. After April 2005, the monitoring data from two additional storm events were available. This proposed TMDL revision incorporates data from additional storm events to establish updated total nitrogen (TN), total phosphorus (TP), and total organic carbon (TOC) event mean concentrations (EMCs) for the Wilmington CSO discharges as shown in Table E-1.

**Table E-1. Revised EMCs for TN, TP, and TOC City of Wilmington CSOs**

| CSO ID         | EMC April 2005 TMDL<br>(mg/L) |       |       | EMC for Revised TMDL<br>(mg/L) |       |       |
|----------------|-------------------------------|-------|-------|--------------------------------|-------|-------|
|                | TN                            | TP    | TOC   | TN                             | TP    | TOC   |
| CSO 4b         | 2.966                         | 0.310 | 6.92  | 2.619                          | 0.334 | 11.94 |
| CSO 25         | 2.947                         | 0.618 | 21.70 | 2.928                          | 0.655 | 20.58 |
| CSO 3          | 4.451                         | 0.690 | 12.63 | 7.591                          | 1.041 | 15.84 |
| All other CSOs | 4.451                         | 0.690 | 12.63 | 2.753                          | 0.339 | 15.68 |

The data from the individual storm events are summarized in Tables E-2, E-3, and E-4. The revised event mean concentrations were calculated using an arithmetic mean of all data associated with a given CSO. For the April 2005 TMDL, data from the 11<sup>th</sup> Street Pumping Station were used to establish EMCs for CSO3 and all other CSOs except for CSO 4b, and CSO 25. For the revised TMDL, data from the 11<sup>th</sup> Street Pumping Station was used to establish the EMC for CSO 3 only. The EMCs for the other CSOs were calculated as the arithmetic mean from the combined storm monitoring data of CSO 4b and CSO 25.

Stormwater runoff sometimes exhibits high pollutant concentrations during the initial stages of a storm. This is referred to as the “first flush”. Examination of the CSO storm monitoring data in Tables E-2, E-3, and E-4 did not indicate any strong first-flush tendency. Larger concentrations were just as likely to occur several hours into the storm event rather than at the beginning. Also, in many of the storms, the concentrations were relatively constant over time. Due to the absence of any definitive evidence in the monitoring data, the first-flush phenomenon was not included in this analysis. Event-mean concentrations were considered appropriate for characterizing the mass loadings from the CSO outfalls.

**Table E-2. Storm monitoring data for CSO 4b**

| Date       | Time  | CBOD20<br>mg/L<br>80087 | CBOD5<br>mg/L<br>80082 | DOC<br>mg/L<br>00681 | TOC<br>mg/L<br>00680 | NH3-N<br>mg/L<br>00610 | NOxN<br>mg/L<br>00630 | TKN<br>mg/L<br>00625 | TN<br>mg/L<br>**** | DOrthP<br>mg/L<br>00671 | TP<br>mg/L<br>00665 | TSS<br>mg/L<br>00530 |
|------------|-------|-------------------------|------------------------|----------------------|----------------------|------------------------|-----------------------|----------------------|--------------------|-------------------------|---------------------|----------------------|
| 10/27/2003 | 11:40 | 14.62                   | 11.70                  | 6.6                  | 9.1                  | 0.362                  | 0.969                 | 1.400                | 2.369              | 0.004                   | 0.238               | 298                  |
| 10/27/2003 | 12:10 | 13.60                   | 5.82                   | 2.9                  | 3.7                  | 0.137                  | 0.248                 | 0.275                | 0.248              | 0.020                   | 0.320               | 278                  |
| 10/27/2003 | 12:40 | 10.20                   | 5.64                   | 6.1                  | 6.2                  | 0.189                  | 0.502                 | 0.644                | 0.502              | 0.100                   | 0.219               | 195                  |
| 10/27/2003 | 13:10 | 14.48                   | 7.85                   | 5.9                  | 7.1                  | 0.238                  | 0.831                 | 1.080                | 1.911              | 0.126                   | 0.270               | 177                  |
| 10/27/2003 | 13:40 | 13.98                   | 7.65                   | 6.8                  | 8.3                  | 0.244                  | 1.070                 | 1.210                | 2.280              | 0.141                   | 0.219               | 75                   |
| 10/27/2003 | 14:10 | 13.50                   | 10.60                  | 7.3                  | 8.9                  | 0.238                  | 1.290                 | 1.370                | 2.660              | 0.159                   | 0.216               | 32                   |
|            |       |                         |                        |                      |                      |                        |                       |                      |                    |                         |                     |                      |
| 12/17/2003 | 09:00 | 16.20                   | 9.20                   | 4.9                  | 6.8                  | 0.403                  | 0.627                 | 2.650                | 3.277              | 0.203                   | 0.388               | 35                   |
| 12/17/2003 | 09:30 | 16.10                   | 8.65                   | 4.7                  | 6.2                  | 0.480                  | 0.855                 | 2.790                | 3.645              | 0.180                   | 0.382               | 34                   |
| 12/17/2003 | 10:00 | 23.80                   | 12.80                  | 6.8                  | 8.4                  | 4.520                  | 1.210                 | 4.830                | 6.040              | 0.222                   | 0.546               | 25                   |
| 12/17/2003 | 10:30 | 16.20                   | 10.60                  | 5.9                  | 6.1                  | 0.504                  | 1.360                 | 3.060                | 4.420              | 0.192                   | 0.416               | 17                   |
| 12/17/2003 | 11:00 | 12.10                   | 8.18                   | 5.5                  | 6.0                  | 0.486                  | 1.710                 | 2.610                | 4.320              | 0.138                   | 0.306               | 19                   |
| 12/17/2003 | 11:30 | 10.60                   | 6.86                   | 5.0                  | 6.2                  | 0.357                  | 1.970                 | 1.950                | 3.920              | 0.112                   | 0.194               | 19                   |
|            |       |                         |                        |                      |                      |                        |                       |                      |                    |                         |                     |                      |
| 11/4/2004  | 13:33 | 25.10                   | 13.10                  | 22.9                 | 24.4                 | 0.206                  | 0.391                 | 1.250                | 1.641              | 0.308                   | 0.489               | 174                  |
| 11/4/2004  | 14:03 | 28.40                   | 15.20                  | 18.3                 | 20.2                 | 0.154                  | 0.337                 | 0.937                | 1.274              | 0.256                   | 0.376               | 31                   |
| 11/4/2004  | 14:33 | 27.40                   | 15.00                  | 20.6                 | 22.8                 | 0.145                  | 0.540                 | 1.060                | 1.600              | 0.268                   | 0.386               | 14                   |
| 11/4/2004  | 15:03 | 24.50                   | 15.60                  | 22.2                 | 23.5                 | 0.113                  | 0.748                 | 1.080                | 1.828              | 0.250                   | 0.314               | 11                   |
| 11/4/2004  | 15:33 | 23.60                   | 13.60                  | 22.5                 | 29.1                 | 0.197                  | 0.710                 | 1.870                | 2.580              | 0.218                   | 0.407               | 27                   |
|            |       |                         |                        |                      |                      |                        |                       |                      |                    |                         |                     |                      |
| EMC        |       | 17.90                   | 10.47                  | 10.29                | 11.94                | 0.528                  | 0.904                 | 1.769                | 2.619              | 0.170                   | 0.334               | 86                   |

**Table E-3. Storm monitoring data for CSO 25**

| Date       | Time  | CBOD20<br>mg/L<br>80087 | CBOD5<br>mg/L<br>80082 | DOC<br>mg/L<br>00681 | TOC<br>mg/L<br>00680 | NH3-N<br>mg/L<br>00610 | NOxN<br>mg/L<br>00630 | TKN<br>mg/L<br>00625 | TN<br>mg/L<br>**** | DOrthP<br>mg/L<br>00671 | TP<br>mg/L<br>00665 | TSS<br>mg/L<br>00530 |
|------------|-------|-------------------------|------------------------|----------------------|----------------------|------------------------|-----------------------|----------------------|--------------------|-------------------------|---------------------|----------------------|
| 10/27/2003 | 11:00 | 13.88                   | 13.88                  | 11.8                 | 14.4                 | 0.325                  | 0.516                 | 1.270                | 1.786              | 0.234                   | 0.296               | 32                   |
| 10/27/2003 | 11:30 | 14.76                   | 14.76                  | 10.3                 | 11.6                 | 0.294                  | 0.503                 | 1.050                | 1.553              | 0.286                   | 0.397               | 33                   |
| 10/27/2003 | 12:00 | 7.83                    | 5.36                   | 3.8                  | 4.3                  | 0.136                  | 0.215                 | 0.392                | 0.215              | 0.113                   | 0.178               | 51                   |
| 10/27/2003 | 12:30 | 12.14                   | 12.14                  | 70.5                 | 80.0                 | 0.421                  | 0.634                 | 3.070                | 3.704              | 1.870                   | 1.620               | 39                   |
| 10/27/2003 | 13:30 | 14.10                   | 14.10                  | 10.6                 | 11.6                 | 0.352                  | 0.820                 | 1.900                | 2.720              | 0.249                   | 0.450               | 26                   |
| 10/27/2003 | 14:00 | 14.26                   | 14.26                  | 10.8                 | 12.0                 | 0.455                  | 1.160                 | 2.480                | 3.640              | 0.354                   | 0.642               | 15                   |
|            |       |                         |                        |                      |                      |                        |                       |                      |                    |                         |                     |                      |
| 12/17/2003 | 08:45 | 15.00                   | 9.48                   | 6.3                  | 6.6                  | 0.350                  | 0.547                 | 1.850                | 2.397              | 0.202                   | 0.102               | 27                   |
| 12/17/2003 | 09:15 | 28.30                   | 19.60                  | 9.1                  | 10.2                 | 0.500                  | 0.839                 | 3.140                | 3.979              | 0.317                   | 0.296               | 22                   |
| 12/17/2003 | 09:45 | 28.76                   | 28.76                  | 40.8                 | 44.6                 | 3.720                  | 1.030                 | 5.500                | 6.530              | 1.560                   | 1.580               | 14                   |
|            |       |                         |                        |                      |                      |                        |                       |                      |                    |                         |                     |                      |
| 11/4/2004  | 13:20 | 28.50                   | 14.90                  | 15.4                 | 18.3                 | 0.476                  | 0.272                 | 1.990                | 2.262              | 0.277                   | 0.505               | 42                   |
| 11/4/2004  | 13:50 | 27.74                   | 15.30                  | 14.0                 | 15.2                 | 0.559                  | 0.315                 | 2.220                | 2.535              | 1.000                   | 1.100               | 39                   |
| 11/4/2004  | 14:20 | 28.00                   | 14.10                  | 17.2                 | 19.1                 | 0.606                  | 0.422                 | 2.630                | 3.052              | 0.385                   | 0.637               | 19                   |
| 11/4/2004  | 14:50 | 26.10                   | 15.10                  | 16.4                 | 19.6                 | 0.712                  | 0.513                 | 3.180                | 3.693              | 0.436                   | 0.706               | 16                   |
|            |       |                         |                        |                      |                      |                        |                       |                      |                    |                         |                     |                      |
| EMC        |       | 19.95                   | 14.75                  | 18.24                | 20.58                | 0.685                  | 0.599                 | 2.359                | 2.928              | 0.560                   | 0.655               | 29                   |

**Table E-4. Storm monitoring data for CSO 3 (11th Street Pumping Station)**

| Date       | Time  | CBOD20<br>mg/L<br>80087 | CBOD5<br>mg/L<br>80082 | DOC<br>mg/L<br>00681 | TOC<br>mg/L<br>00680 | NH3-N<br>mg/L<br>00610 | NOxN<br>mg/L<br>00630 | TKN<br>mg/L<br>00625 | TN<br>mg/L<br>**** | DOrthP<br>mg/L<br>00671 | TP<br>mg/L<br>00665 | TSS<br>mg/L<br>00530 |
|------------|-------|-------------------------|------------------------|----------------------|----------------------|------------------------|-----------------------|----------------------|--------------------|-------------------------|---------------------|----------------------|
| 10/27/2003 | 11:20 | 11.76                   | 11.76                  | 23.5                 | 29.6                 | 4.040                  | 0.467                 | 7.250                | 7.717              | 0.262                   | 1.470               | 454                  |
| 10/27/2003 | 11:50 | 10.88                   | 10.88                  | 9.5                  | 11.9                 | 3.070                  | 1.100                 | 3.820                | 4.920              | 0.433                   | 0.520               | 71                   |
| 10/27/2003 | 12:10 | 10.88                   | 10.88                  | 7.7                  | 9.6                  | 1.520                  | 0.545                 | 1.450                | 1.995              | 0.202                   | 0.357               | 166                  |
| 10/27/2003 | 12:50 | 12.98                   | 9.02                   | 4.6                  | 5.8                  | 2.200                  | 0.517                 | 1.400                | 1.917              | 0.003                   | 0.366               | 144                  |
| 10/27/2003 | 13:20 | 11.82                   | 11.82                  | 13.9                 | 15.3                 | 1.720                  | 0.646                 | 0.964                | 1.610              | 0.167                   | 0.289               | 104                  |
| 10/27/2003 | 13:50 | 11.66                   | 11.66                  | 6.8                  | 8.5                  | 2.340                  | 0.753                 | 1.880                | 0.753              | 0.311                   | 0.420               | 106                  |
|            |       |                         |                        |                      |                      |                        |                       |                      |                    |                         |                     |                      |
| 12/17/2003 | 08:50 | 82.32                   | 29.30                  | 8.5                  | 10.4                 | 3.040                  | 0.682                 | 6.790                | 7.472              | 0.157                   | 1.160               | 143                  |
| 12/17/2003 | 09:20 | 26.50                   | 13.80                  | 5.3                  | 6.3                  | 4.520                  | 0.732                 | 4.880                | 0.732              | 0.129                   | 0.630               | 86                   |
| 12/17/2003 | 09:50 | 29.60                   | 15.40                  | 6.0                  | 8.2                  | 1.650                  | 0.820                 | 4.900                | 5.720              | 0.004                   | 0.632               | 91                   |
| 12/17/2003 | 10:20 | 20.80                   | 14.30                  | 6.7                  | 9.1                  | 3.530                  | 0.842                 | 4.670                | 5.512              | 0.019                   | 0.645               | 73                   |
| 12/17/2003 | 10:50 | 42.40                   | 23.70                  | 7.3                  | 11.3                 | 2.940                  | 1.200                 | 5.910                | 7.110              | 0.004                   | 0.883               | 106                  |
| 12/17/2003 | 11:20 | 82.05                   | 82.05                  | 21.4                 | 25.5                 | 1.150                  | 1.140                 | 6.810                | 7.950              | 0.341                   | 0.909               | 64                   |
|            |       |                         |                        |                      |                      |                        |                       |                      |                    |                         |                     |                      |
| 11/4/2004  | 13:25 | 26.82                   | 13.58                  | 20.1                 | 22.6                 | 4.340                  | 0.460                 | 23.200               | 23.660             | 0.007                   | 3.400               | 553                  |
| 11/4/2004  | 13:55 | 30.00                   | 13.70                  | 16.0                 | 23.2                 | 3.080                  | 0.463                 | 12.300               | 12.763             | 0.210                   | 1.650               | 189                  |
| 11/4/2004  | 14:25 | 29.50                   | 12.96                  | 15.6                 | 20.0                 | 2.780                  | 0.506                 | 10.600               | 11.106             | 0.182                   | 1.130               | 181                  |
| 11/4/2004  | 14:55 | 24.36                   | 13.40                  | 14.6                 | 21.5                 | 3.140                  | 0.430                 | 12.600               | 13.030             | 0.274                   | 1.470               | 122                  |
| 11/4/2004  | 15:25 | 20.70                   | 12.40                  | 16.7                 | 21.2                 | 3.050                  | 0.533                 | 11.200               | 11.733             | 0.605                   | 1.480               | 128                  |
| 11/4/2004  | 15:55 | 23.50                   | 12.80                  | 20.9                 | 25.2                 | 2.800                  | 0.630                 | 10.300               | 10.930             | 0.644                   | 1.320               | 104                  |
|            |       |                         |                        |                      |                      |                        |                       |                      |                    |                         |                     |                      |
| EMC        |       | 28.25                   | 17.97                  | 12.51                | 15.84                | 2.828                  | 0.693                 | 7.274                | 7.591              | 0.220                   | 1.041               | 160                  |

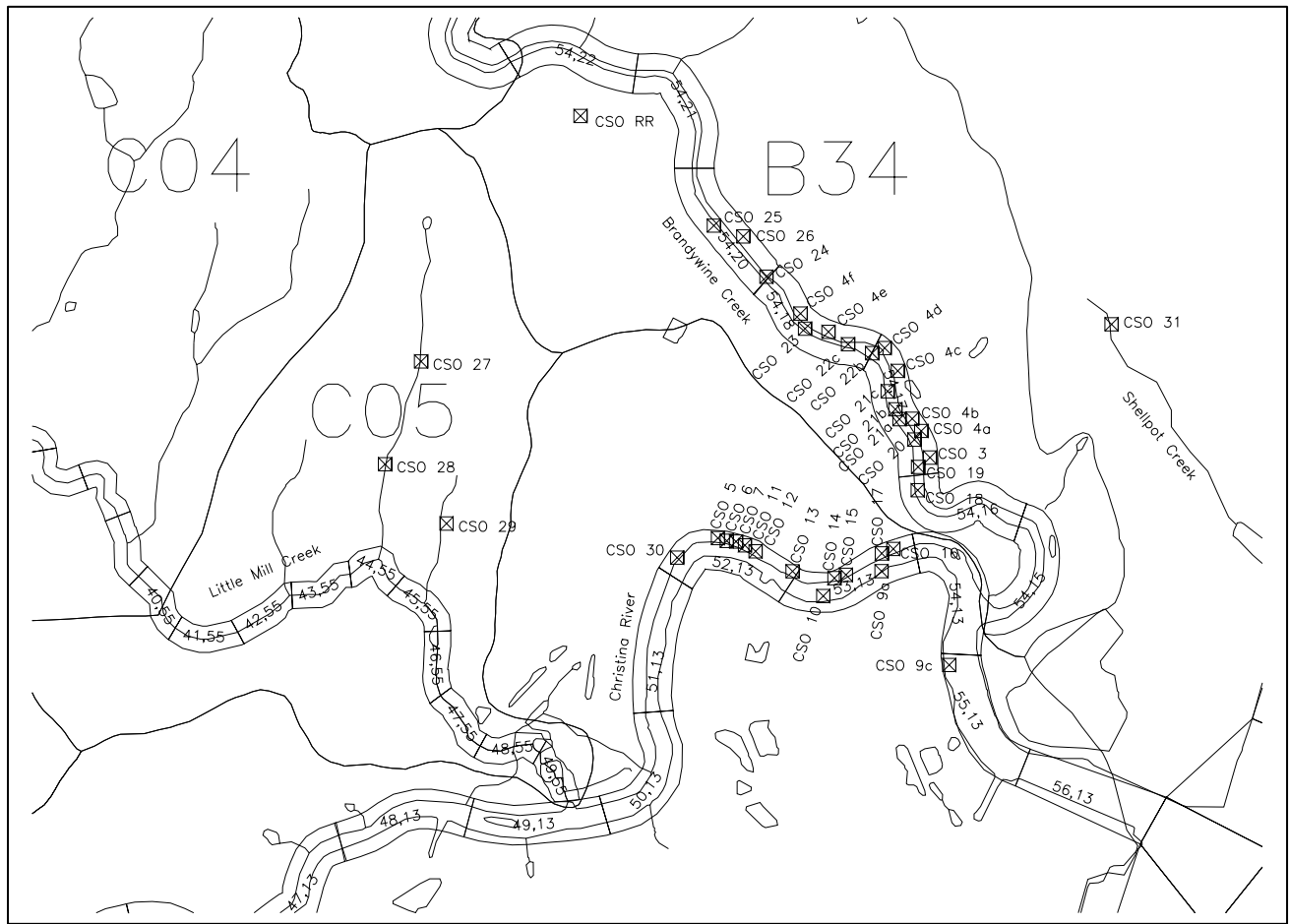
## **E.2 Summary of Annual Baseline and TMDL CSO Nitrogen and Phosphorus Loads**

A summary of the baseline and TMDL CSO nitrogen and phosphorus annual average loads grouped by EFDC model grid cell location is presented in Table E-5. The locations of the CSO discharges and the EFDC model grid cells are shown in Figure E-1. Note that CSO 31 discharges to Shellpot Creek, which flows into the Delaware River and is outside the Christina River Basin, therefore it is not included in the CSO load totals for the baseline and TMDL columns in Table E-5. The following CSOs were assigned zero flow (i.e., 100% load reduction) for the TMDL allocation: 4b, 4c, 4f, 12, 14, 15, 18, 20, and Rockford Road (RR).

**Table E-5. Baseline and TMDL average annual loads for CSOs grouped by EFDC grid cell**

| Location (subbasin)                  | EFDC Cell [I,J] | CSO ID numbers                           | Baseline (kg/yr) | TMDL (kg/yr) | Reduction |
|--------------------------------------|-----------------|--|------------------|--------------|-----------|
| Total Nitrogen                       |                 |  |                  |              |           |
| Little Mill Creek (C05)              | [44,55]         | 27, 28                                   | 683.6            | 162.1        | 76.3%     |
| Little Mill Creek (C05)              | [45,55]         | 29                                       | 267.5            | 63.5         | 76.3%     |
| Christina River (C09)                | [52,13]         | 5, 6, 7, 11, 12, 13, 30                  | 1055.2           | 363.2        | 65.6%     |
| Christina River (C09)                | [53,13]         | 9a, 10, 14, 15, 16, 17                   | 1057.4           | 229.6        | 78.3%     |
| Christina River (C09)                | [55,13]         | 9c                                       | 52.2             | 2.6          | 95.1%     |
| Brandywine Cr. (B34)                 | [54,16]         | 18                                       | 0.4              | 0.0          | 100.0%    |
| Brandywine Cr. (B34)                 | [54,17]         | 3, 4a, 4b, 4c, 4d, 19, 20, 21a, 21b, 21c | 2210.1           | 398.2        | 82.0%     |
| Brandywine Cr. (B34)                 | [54,18]         | 4e, 4f, 22b, 22c, 23, 24                 | 262.1            | 261.0        | 0.4%      |
| Brandywine Cr. (B34)                 | [54,20]         | 25, 26                                   | 1643.6           | 839.9        | 48.9%     |
| Brandywine Cr. (B34)                 | [54,21]         | RR                                       | 60.6             | 0.0          | 100.0%    |
| Shellpot Creek - CSO 31*             | [57,15]         | 31                                       | 258.8            | 182.1        | 29.6%     |
| Total Average Annual Nitrogen Load   |                 |  | 7292.7           | 2319.9       | 68.2%     |
| Total Phosphorus                     |                 |  |                  |              |           |
| Little Mill Creek (C05)              | [44,55]         | 27, 28                                   | 115.7            | 27.4         | 76.3%     |
| Little Mill Creek (C05)              | [45,55]         | 29                                       | 45.3             | 10.6         | 76.6%     |
| Christina River (C09)                | [52,13]         | 5, 6, 7, 11, 12, 13, 30                  | 178.5            | 61.7         | 65.4%     |
| Christina River (C09)                | [53,13]         | 9a, 10, 14, 15, 16, 17                   | 178.9            | 38.7         | 78.4%     |
| Christina River (C09)                | [55,13]         | 9c                                       | 8.8              | 0.4          | 95.8%     |
| Brandywine Cr. (B34)                 | [54,16]         | 18                                       | 0.0              | 0.0          | 0.0%      |
| Brandywine Cr. (B34)                 | [54,17]         | 3, 4a, 4b, 4c, 4d, 19, 20, 21a, 21b, 21c | 328.9            | 60.2         | 81.7%     |
| Brandywine Cr. (B34)                 | [54,18]         | 4e, 4f, 22b, 22c, 23, 24                 | 44.9             | 44.5         | 0.8%      |
| Brandywine Cr. (B34)                 | [54,20]         | 25, 26                                   | 333.6            | 161.7        | 51.5%     |
| Brandywine Cr. (B34)                 | [54,21]         | RR                                       | 10.2             | 0.0          | 100.0%    |
| Shellpot Creek - CSO 31*             | [57,15]         | 31                                       | 43.8             | 30.7         | 30.0%     |
| Total Average Annual Phosphorus Load |                 |  | 1244.7           | 405.2        | 67.4%     |

\*CSO31 not included in total CSO load since it discharges outside of Christina River Basin



**Figure E-1. Location of CSO discharges in relation to EFDC model grid cells**

### E.3 Revision of Groundwater Flows and Loads

Groundwater flows and nutrient loads for some of the HSPF subbasins were incorrectly added twice to the EFDC water quality model for the April 2005 TMDL. This problem with the HSPF-EFDC linkage was corrected and the proper groundwater flows and loads are used for this revised TMDL. The EFDC water quality model was re-calibrated following the correction of the groundwater flows and loads.

#### E.4 Updated NPDES Information

The HSPF and EFDC models were calibrated using information for the 1994-1998 period, including NPDES facilities that were in existence at that time. The NPDES facilities were updated prior to the April 2005 TMDL. Additional information on the NPDES discharges has become available since issuance of the April 2005 TMDL and has been incorporated into this revised TMDL. The changes to the NPDES discharges are listed in Table E-6. In addition to the changes listed in Table E-6, the April 2005 model used permit limits for ammonia nitrogen of 10 mg/L and total nitrogen of 20 mg/L for the small residence discharges (flow rate of 500 gpd). For this revised TMDL, the permit limits for ammonia nitrogen and total nitrogen were changed to 30 and 40 mg/L, respectively, which are more appropriate for

these types of small discharges. This change in nitrogen loading from the small residence discharges had negligible impact on receiving water quality.

**Table E-6. List of updated NPDES information for Christina River Basin**

| <b>NPDES Permit</b> | <b>HSPF subbasin</b> | <b>Name</b>                                       | <b>Description of Change</b>  |
|---------------------|----------------------|---|---|
| PA0012416           | B03                  | PA American Water (Rock Run)                      | New owner (previously owned by Coatesville)                               |
| PA0011568-001       | B05                  | ISG Plate LLC (Sucker Run, W. Br. Brandywine Cr.) | New owner (previously owned by Lukens Steel)                              |
| PA0011560-016       | B05                  | ISG Plate LLC (Sucker Run, W. Br. Brandywine Cr.) | New owner (previously owned by Lukens Steel)                              |
| PA0055492           | B10                  | Andrew and Gail Woods (Indian Run)                | New owners (previously owned by John and Jane Topp)                       |
| PA0051365           | B11                  | PA American Water (E. Br. Brandywine Cr.)         | New owner (previously owned by West Chester Area Municipal Authority)     |
| PA0026531           | B13                  | Downingtown Area WWTP (E. Br. Brandywine Cr.)     | Flow increase from 7.134 to 7.500 mgd                                     |
| PA0244031           | B16                  | Chadds Ford Township (Brandywine Cr.)             | Replaces PA0047252 (Pantos Corp.).<br>Flow increase from 0.07 to 0.15 mgd |
| PA0055085           | B16                  | Nancy Winslow (Brandywine Cr.)                    | Active during 1994-98 calibration period.<br>No longer exists.            |
| PA0036161           | B20                  | Lincoln Crest MHP (Buck Run)                      | Active during 1994-98 calibration period.<br>No longer exists.            |
| PA0053937           | B29                  | William and Patricia Kratz (Broad Creek)          | New owners (previously owned by Ralph and Gayla Johnson)                  |
| PA0056952           | W04                  | Sun Company, Inc. (E. Br. White Clay Cr.)         | Active during 1994-98 calibration period.<br>No longer exists.            |
| PA0052019           | W04                  | Avon Grove Trailer Court (E. Br. White Clay Cr.)  | Active during 1994-98 calibration period.<br>No longer exists.            |
| PA0029343           | W06                  | Chatham Acres (E.Br. White Clay Cr.)              | Active during 1994-98 calibration period.<br>No longer exists.            |
| PA0057720-001       | R01                  | Sunny Dell Foods, Inc. (W. Br. Red Clay Cr.)      | Flow increase from 0.05 to 0.072 mgd                                      |